Spatial patterns and size-frequency distribution of thermokarst lakes in the middle basin of the Rena River

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Eastern Siberia is characterized by widespread permafrost thawing and subsequent thermokarst development. The estimation of the impacts of the expected rise in precipitation and air temperatures owing to climate change requires quantitative knowledge about the spatial distribution of thermokarst development. This study examines the spatial patterns and size-frequency distributions of thermokarst lakes in the middle basin of the Rena River. The thermokarst lakes were detected by using Landsat, RapidEye, and Planet images. We further analyzed the relationship between the lake density and the Lena River terraces (Soloviev, 1959) and the statistical relation between the lake area and frequency.

The results show that the spatial distribution of the lakes on the right bank was not uniform. The lower terraces tended to have a higher density for the larger lakes, i.e., those of area $>10^5$ m^2. In contrast, the higher terraces were characterized by low lake density. These results indicate that the differences in topography (Saito et al., 2018), surface geology, ground ice content in each terrace (Ulrich et al., 2017), and local human activities (Fedorov et al., 2014) are important controlling factors for thermokarst lake development. Additional studies are necessary to verify the lake distribution in terms of thermal and mechanical erosional processes.

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